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AN ANALYSIS OF FACTOR AFFECTING ACADEMIC ACHIEVEMENT: A STRUCTURAL EQUATION MODELLING APPROACH

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ABSTRACT

The study offered an assessment of the factors that are believed to directly and/or indirectly influence academic achievement. A correlation analysis of the factors was first carried out and it was established that some of the factors were significantly correlated. One of the assumptions of multiple regression analysis is the non-existence of multicollinearity. Independent variables need not be significantly correlated. In addition, multiple linear regression looks at direct relationships between the dependent variable and each of the independent variables. In this study access-to-resources and attendance were found to be significantly correlated to parental-involvement and parental-education-level respectively. This ruled out the use of multiple linear regression modelling paving way for structural equation modeling which was used to establish not only relationships between the dependent variable and a set of independent variables but also relationships among the independent variables themselves. Factors that have direct effects as well as those that have indirect effects to exam-score were established. Gender and school-type were found to have no effect on academic achievement.

Keywords: Regression Analysis, Socio-Economic-Status, Structural Equation Modelling, Multicollinearity, Accommodation, Assimilation.

1. INTRODUCTION

Academic achievement is the central goal of education. It is a key metric for measuring a student's long-term well-being. Because of that, many researches have been done in order to establish the factor that affect it. Several statistical modeling techniques, with multiple linear regression analysis being the most common, have been used in this endeavor. In the multiple linear regression model, there is one dependent variable and two or more independent variables. This modelling technique assumes that the independent variables have only direct effects on the dependent variable. The technique also assumes that the independent variables are not significantly linearly correlated. In education, some home-based as well as other school-based factors are linearly related. This makes multiple linear regression analysis unsuitable. There is therefore, need to use techniques other than multiple linear regression when modelling academic performance.

In this study, academic achievement is modelled through structural equation modeling. This technique is proposed because it accommodates linear relationships among the independent variables. This means that we can have mediating variables, that is, variables that are dependent and independent at the same time. The remaining part of the study is composed of the literature, methods, results, discussion, implications and conclusion.

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2. LITERATURE

Academic achievement is the key metric for measuring a student's future well-being. It is so important to the extent that a significant percentage of those who pursue other avenue to earn a living do so after failing to make it along the academic path. Theory of education states that academic performance of any learner is a product of his or her psychological, socio-economic and environmental factors, (Akrofi; 2020). Mathematical modelling of academic achievement using these factors is a common practice. Though there are many techniques that are used in modelling this performance, multiple linear regression modelling is the most common.

In a study that aimed at establishing the relationship between home-environment and reading achievement in Zimbabwe, Kanyongo et al used multiple linear regression. Reading-score was the dependent variable. Home environment was divided into several independent variables that include socio-economic-status, homework monitored at home, homework assistance at home, extra reading at home, number of meals and number of books at home. Socio-economic-status was measured by the availability of a TV, refrigerator, piped water and electricity. The variables listed above are some of those that were found to be significant predictors of reading achievement. The fact that socio-economic status was found to have a significant effect on reading achievement is against Akrofi's claim that researches reveal that parental socio-economic status has no direct effect on the academic performance of children. (Akrofi; 2020) uses frequencies and percentages, which are weaker methods of analysis, to validate his views. This could be the reason why his results are unexpected. Sharing a similar view on the effects of socio-economic status on academic performance is Adane (2013) who argues that educated parents foster learning in the child by providing school-related materials such as stationery, computer, story books and others. This implies an indirect influence. The provision of these materials vary in both quantity and quality from one parent to another hence constitutes a variable. This variable together with parents' educational qualification, children's health statuses and many others, influence the home environment factor that affect children's academic achievement, Ogunshola et al (2014). Like (Akrofi; 2020), (Ogunsola; 2014) also uses frequencies and percentage to analyze his data.

As children start going to school, the new environment teaches them new concepts, building on those brought from home. (Akrofi; 2020) claims that in doing their work, schools ignore the home and choose to operate independently. This cannot be so since children are often given homework which is done in the home environment with home factors playing a significant role. This is in line with (Marzano; 2003) who states that educated parents provide an environment that is suitable for the success of their children in academics.

Damavandi et al (2011) employed analysis of variance to establish the impact of thinking and learning styles on academic performance. Kolb's four leaning styles, namely the diverging, converging, the assimilating and the diverging, were the factor levels. A sample of 285 grade 10 students was divided into four categories, according to the learning styles. This was done after establishing each participant's style of learning. Academic achievement was the dependent variable in this study. Results of the study showed that the learning styles had different levels of impact on academic achievement.

These learning styles do not just develop from nowhere. The home contributes significantly to the psychological development of a learner which has an effect on academic performance at school, Mar et al (2016). The styles can be modeled statistically using the various home, school and environment factors that are known to influence them. In turn, academic performance can also be modeled using the learning styles as the independent variables.

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In Bangladesh, Nath ran five regression models in an attempt to find factors that influence primary students' learning achievement. The factors were first divided into three categories. These categories were Socio-economic factors, School-based factors and Additional educational inputs. A linear regression model was run for each of these categories. The forth model had the combination of the socio-economic factors and the school-related factors as independent variables. Model five combined all the three categories of factors as independent variables. Learning achievement was the dependent variable in each of the cases. Of the twenty-one independent variables that were used in the final model, sixteen had significant influence on learning achievement. However, this model explained only 23 percent of the variation in the dependent variable.

In a similar study, Afrifa et al used data from seven hundred and twenty students from three colleges to assess the factors affecting academic performance. Multiple linear regression was used in this research. Pre-tertiary institution status, parent socioeconomic status, quality of education environment, hours study per day, festivity reading style, personality traits, regularity to class, health status intelligent quotient were the independent variables of the model. Grade point average was the dependent variable. Intelligence Quotient, festivity, regularity to class, and personality traits were found to significantly affect academic success. Health, number of hours studied per day, and parent socio-economic factors were proved to be insignificant in this study. These results differ from those obtained by Kanyongo et al. This variations in findings suggests that there are differences in the characteristics of the datasets. There is need to do our modelling using a technique that is robust.

Multiple linear regression is too restrictive. Some of its assumptions do not hold for factors affecting academic attainment. This is the reason why this study is proposing structural equation modelling to model academic performance.

3. METHODS

This research was designed for determining factors that have direct and/or indirect effects on students' academic achievement. Secondary data from Kaggle was analyzed using SPSS Amos version 23. The data had twenty variables that included exam-score, which was the dependent variable. Some of the variables were quantitative while others were qualitative. Most of the qualitative variables were measured on an ordinal scale. The values of these variables were coded using a likert-scale that had points that depended on the values of each variable. Gender and school-type are the only variables that were nominal. Each of these two was binary and their values were also coded. This study used only seventeen of the independent variables and these were hours-studied, attendance, parental-involvement, access-to-resources, extracurricular-activities, motivation-level, internet-access, tutoring-sessions, family-income, teacher-quality, school-type, peer-influence, parental-education-level, distance-from-home, learning disability, physical activity and gender. Structural equation modeling was the main technique used in order to achieve the stated goal.

4. RESULTS

Shown below are output tables from SPSS Amos version 23.

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Table 1: Chi-square (CMIN) statistic for model fitness.

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	37	109.919	134	.937	**0.820**
Saturated model	171	.000	0		
Independence model	18	7933.569	153	.000	51.853

Table 1 shows a chi-square value of 0.820 (in bold print). Since this value is less than 5.000, the model is taken to have a good fit to the data.

Table 2: RESEA statistic for model fitness.

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	**0.000**	.000	.002	1.000
Independence model	0.088	.086	.089	.000

Table 2 shows an RMSEA value of 0.000 (in bold print). For a model to have good fit to the data, the RMSEA must be less than 0.08. The value in the table is less than 0.08 as required. Table 2, therefore, supports Table 1 that the model has a good fit.

Correlation analysis was done to establish which of the independent variables were significantly related. The significant relationships among the independent variables were included in the final model.

Table 3: Regression Weights

			Estimate	S.E.	C.R.	P	Label
Parental-Involvement	<-	Parental-Education-Level	-0.008	0.011	-0.740	0.459	par_20
Access-to-Resources	<-	Parental-Involvement	-.027	.012	-2.159	.031	par_1
Attendance	<-	Parental-Education-Level	.382	.180	2.125	.034	par_9
Exam-Score	<-	Internet-Access	.931	.100	9.289	***	par_2
Exam-Score	<-	Teacher-Quality	.514	.044	11.693	***	par_3
Exam-Score	<-	Access-to-Resources	1.048	.038	27.617	***	par_4
Exam-Score	<-	Tutoring-Sessions	.491	.022	22.820	***	par_5
Exam-Score	<-	Peer-Influence	.495	.035	14.131	***	par_6
Exam-Score	<-	Attendance	.198	.002	86.118	***	par_7
Exam-Score	<-	Gender	-.041	.054	-.756	.450	par_8
Exam-Score	<-	Motivation-Level	.538	.038	14.118	***	par_10

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Exam-Score	<-	Hours-Studied	.297	.004	67.222	***	par_11
Exam-Score	<-	Extracurricular-Activities	.566	.054	10.477	***	par_12
Exam-Score	<-	Distance-from-Home	-.471	.039	-12.185	***	par_13
Exam-Score	<-	Family-Income	.521	.036	14.609	***	par_14
Exam-Score	<-	School-Type	-.044	.058	-.762	.446	par_15
Exam_-Score	<-	Parental-Education-Level	.454	.034	13.530	***	par_16
Exam-Score	<-	Parental-Involvement	.980	.038	25.704	***	par_17
Exam-Score	<-	Physical-Activity	.179	.026	6.967	***	par_18
Exam-Score	<-	Learning-Disabilities	-.840	.086	-9.727	***	par_19

Table 3 depicts the regression coefficients of the structural equation model. From this table it is clear that gender and school-type are not significant predictors of academic achievement in this study. Also to note, as expected, is that learning-disability and distance-from-home are negatively related to exam-score. In addition to these significant predictors of exam-score, the relationship between access-to-resources and parental-involvement and that between attendance and parental-education-level are significant. The rest of the indirect paths from the various factors to exam-score were removed from the output table because they were insignificant. In Table 3 we also see that parental-education-level and parental-involvement are not significantly related. Also on the association between these two variables, a chi-square test was carried out and the test had a p-value of 0.469, leading to the non-rejection of the no association hypothesis.

5. DISCUSSION

Of interest here is the significant relationship between access-to-resources and parental-involvement and that between attendance and parental-education-level. Such relationships are not a characteristic of multiple linear regression analysis, hence the need for structural equation modelling. Multiple linear regression only deals with direct relationships between the dependent variable and the several independent variables. Structural equation modelling has this advantage of going further to tell us how we can improve intermediate variables like attendance in this case. We can manipulate factors that affect these intermediate variables since they are in such sense dependent variable that are being explained by others. In this case, we see from Table 3 that parental-education-level is a significant predictor of attendance, hence one can improve attendance by educating the parent. We see from here that parental-education-level has both a direct and an

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indirect effect on exam-score. This means that educating the parent will positively affect exam-score in two different ways.

What is happening between attendance and parental-education-level is also seen between access-to-resources and parental-involvement. Parental-involvement directly and indirectly affects exam-score. The indirect path is through access-to-resources. Parents, therefore, influence the exam-score of their children through several ways that include having the parents acquire education, affecting attendance, involvement in their children's education activities and improving their children's access to resources.

6. IMPLICATIONS

One implication of this study is that researchers should prefer structural equation modelling to multiple linear regression when modelling academic attainment as the former reveals more information than the latter. Educators, knowing the importance of the roles played by parents in promoting the performance of children, should ensure that the parents are involved in all that has to do with their children at school. The identification of factors that have indirect effects on academic performance is an added advantage as it widens the area from which researchers in general and educators in particular, can improve academic achievement.

7. CONCLUSION

The use of structural equation modelling in steady of multiple linear regression modelling showed that there are significant linear relationships not only between academic attainment and several of the listed factors but also among some of the factors that explain the variations in academic performance. From this study, it was discovered that, in addition to having significant effects on academic attainment, parental-Involvement and parental-education-level have significant effects on access-to-resources and attendance respectively. It was also noticed that gender and school-type do not affect academic performance.

REFERENCES

Alireza Jilardi Damavandi, Rahil Mahyuddin, Habibah Elias and Shafee Mohd Daud (2011) Academic Achievement of Students with Different Learning Styles, International Journal of Psychological Studies, Vol. 3, No. 2.

Gibbs Y. Kanyongo, Janine Carto and Brown I. Launcelot (2006) Using regression analysis to establish the relationship between home environment and reading achievement: A case of Zimbabwe. International Education Journal, 2006, 7(5), 632-641.

James Afrifa, Rafiyatu Hafisu, Kulari Omri Tanzamado and Bongi Veino Leslie: An Analysis of Significant Factors Influencing Students' Academic Performance in a Predictive Model Using Multiple Regressions, International Research Journal of Modernization in Engineering Technology and Science, Volume:05/Issue:02/February-2023.

Linda Ofosua Adane, "Factors affecting low academic achievement of pupils in Kemp Methodist Junior High School in Aburi, Eastern region." PhD diss., University of Ghana, 2013.

Marzano, R. J. (2003). *What Works in Schools: Translating Research into Action.* Mathematics. Oxford, Pergamum.

Mary N. Gabriel, Lewis M. Ngesu, Isaac Muasya, Timothy Maonga, and Maira J. Mukhungulu. "Parental socio economic status academic achievement in selected secondary schools in urban informal settlements in Westlands Division, Nairobi County." (2016).

ISSN: 2582-0745
Vol. 8, No. 01; 2025

Mullis, I. V. (2006) *International Mathematics Report*. Boston, M. A: TIMSS Center College.
Nadenge, G.; Ngesu, L.; Muasya, I.; Maonga; T. & Maira, M. (2016). Parental Socio-Economic Status and Students' Academic Achievement in Selected Secondary Schools in Urban Informal Settlements in Westlands Division, Nairobi County. *International Journal of Education and Social Science* Vol. 3 No. 1; pp 43-55.
Ogunsola, O. K., Osuolale, K. A. & Ojo, A. O. (2014). Parental and Related Factors Affecting Students' Academic Achievement in Oyo State, Nigeria. World Academy of Science, Engineering and Technology International Journal of Educational and Pedagogical Sciences.Vol.8 ((9):3137-3144.
Olivia Akrofi (2020) Academic Achievement of Primary School Pupil: Investigating Home Environment Factors' Contribution to Low Academic Performance: E-Journal of Humanities, Arts and Social Sciences (EHASS), Volume 1 Number 1 June 2020 pp 49-57 Available online at https://noyam.org/journals/ehass/.
Olivia Akrofi (2020) "Parental involvement in school guidance and counselling of the adolescent". University of Cape Coast, Cape Coast.
Robitaille, D. E. (2006). *The IEA Study of Mathematics: Contexts and Outcomes of School Mathematics*. Oxford, Pergamum.
Samir Ranjan Nath (2012) Factors influencing primary students' learning achievement in Bangladesh, Research in Education, No 88.
Schaeffer, D. (2009). *Social and Personality Development.* Belmont, CA: Wadsworth.